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A SOURCE OF COLD ATMOSPHERIC-PRESSURE PLASMA*

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The problem of creating a source of non-equilibrium low-temperature plasma, formed upon excitation of the ambient air and having a temperature of the order of room one or slightly higher, continues to be extremely urgent. Despite the huge amount of research in this direction, such a plasma source has not been implemented yet. However, such a source is extremely promising from a practical point of view and can be used in various fields [1].

The study deals with the results of studies of the characteristics of a source of cold air plasma based on the relatively recently discovered phenomenon of the gas discharge physics – an apokampic discharge (Fig. 1a) [2]. Its formation is due to streamers propagating at a high speed from the bright branch (3 in Fig. 1a) of the pulse discharge channel (2 in Fig. 1a). It should be noted that this type of discharge can be considered as a laboratory model of the phenomena occurring in the upper atmosphere of our planet and not only, i.e. Transient Luminous Events such as blue jets, starters and red sprites [2].

A source design is proposed in which several apokamps are localized and stabilized at the center due to the gas flowing. Measurements of electronic, vibrational, rotational, and gas temperatures, as well as the reduced electric field strength in plasma in various zones of the discharge formed in this design were carried out by optical emission spectroscopy techniques [3]. It is shown that everywhere plasma is strongly non-equilibrium – there is a strong difference between the electronic temperature (several eV) and the temperature of heavy particles (hundreds to thousands of K, depending on the measurement zone). Thus, a cold air plasma source based on the apokampic discharge has been implemented (Fig. 1c).

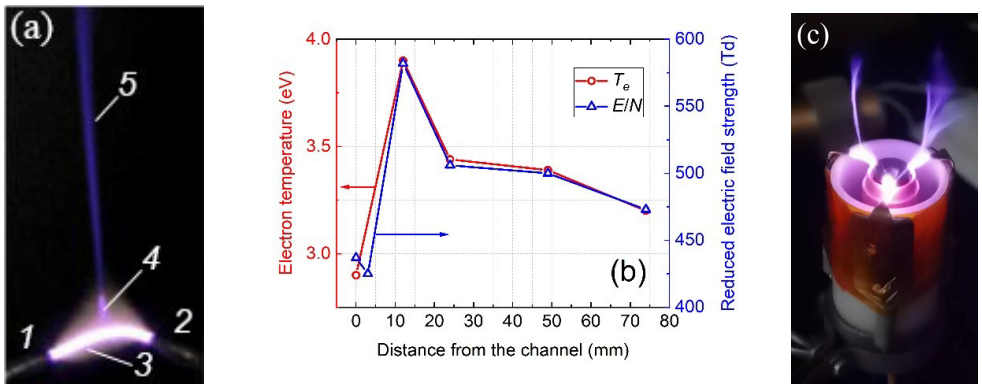

Fig.1. (a) Apokampic discharge. 1, 2 – electrodes; 3 – discharge channel; 4 – bright branch; 5 – plasma plume. (b) Electron temperature and reduced electric field strength at different distances from the main discharge channel (3 in Fig. 1a). (c) Multiapokampic atmospheric-pressure air plasma source.

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